

The proposed drawing replacement sheets filed January 14, 2008 have been approved.

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1, 2, 4-8 and 11-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Leung I (5,198,677) taken in view of Kaufman (4,481,062) and Leung II (5,587,226), and optionally taken in further view of Cuomo (4,351,712). Leung I (5,198,677) discloses an ion source (Fig. 1) including a plasma generating chamber, magnets arranged around the chamber, a tungsten filament that is heated by a filament power source, a gas port, a bias DC power source, and an array of magnets at the exit of the chamber that act as a magnetic filter of the type claimed by applicants. Leung I teaches that his magnetic filter design desirably produces a stream of mainly atomic ions. Leung's ion source also includes a cooling channel formed between a plasma generation chamber and a cylindrical wall for cooling magnets in the channel; and a liner made of a high-temperature resistant material such as molybdenum provided within the chamber (column 3, line 10 through column 4, line 10). Leung I uses a DC power source 58 to heat the tungsten filament and does not discuss the use of an AC power source to heat his tungsten filament. Also, Leung I does not discuss using his ion source to generate atomic oxygen ions. Kaufman (see Fig. 1 and col. 5, lines 1-6) teaches that either an AC or DC power source can be used to heat a tungsten filament

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to thermionic temperatures. It would have been prima facie obvious to one skilled in the art to modify the ion source of Leung I (5,198,677) by substituting an AC power source for Leung's DC power source 58, because Kaufman teaches that an AC power source was known to be a functional equivalent power source for heating a tungsten filament to thermionic temperatures. Regarding the production of atomic oxygen ions, Leung II (5,587,226) teaches (see the entire patent and in particular col. 13, lines 7-29 and col. 15, lines 13-41) that it is desirable to produce a stream of atomic oxygen ions for materials processing, and Leung II (5,587,226) also teaches that a magnetic filter of the type used by Leung I will produce such a stream of atomic oxygen ions. Therefore, it would have been obvious to one skilled in the art to use the atomic ion source of Leung I (5,198,677) to produce the desired atomic oxygen ions by providing the Leung I ion source with a source of oxygen as presently claimed. Leung II also teaches (see col. 15, lines 15-41) that his antenna ion source is more desirable for oxygen ion production than a DC discharge ion source of the type disclosed by Leung I. It is noted, however, that a non-preferred embodiment disclosed in the prior art can properly be used as a prior art teaching. The use of a non-preferred embodiment would have been obvious to one willing to accept the drawbacks taught. See In re Boe, 148 USPQ 507; In re Mills, 176 USPQ 196 and In re Susi 169 USPQ 423.

Regarding the newly added limitation of "an oxygen plasma producing element for producing oxygen plasma with atomic oxygen ions having energies less than 100eV", it is noted that this limitation is a process-type limitation that does not so limit the present apparatus claims. This limitation is in effect a recitation of intended use that

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the Leung I apparatus is inherently capable of practicing. Leung I (see col. 4, lines 29-30) that his apparatus produces low energy ions, such as  $N^+$  ions that typically have energies of 0.25 eV to several eV. While Leung I doesn't specifically discuss  $O^+$  ion energies that can be produced in his apparatus, it is noted that Leung's apparatus operates within the same range of discharge voltage and vacuum pressure as applicants' apparatus. This was discussed on page 8 of the Final rejection mailed December 6, 2006. Therefore, Leung's apparatus is inherently capable of operating in the same way as applicants' apparatus, including producing  $O^+$  ions of an energy that is less than 100 eV. Furthermore, Cuomo (see Fig. 1 and the paragraph bridging cols. 3 and 4) also discloses a thermionic cathode plasma apparatus that includes a thermionic filament 1, and Cuomo teaches that oxygen can be ionized to produce oxygen ions having an energy of less than 100 eV by using a discharge voltage of 70 volts and a current of 13 amps, which are approximately the same as Leung's operating parameters of 80 volts and 10 amps (see Leung I at col. 5, lines 35-45). Therefore, one skilled in the art would recognize that Leung's apparatus is inherently capable of producing oxygen plasma having atomic oxygen ions of an energy of less than 100 eV as now claimed. It should be emphasized that the present apparatus claims do not require that the claimed apparatus ever actually be used to produce ions of the claimed energy range, but only require the claimed apparatus has the technical capability of doing so.

Claims 3 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Leung I (5,198,677) taken in view of Kaufman (4,481,062) and Leung II (5,587,226), and optionally taken in further view of Cuomo (4,351,712), for the reasons stated in the

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rejection of claims 1, 2, 4-8 and 11-14 above, and taken in further view of Anderson (US Patent No. 5,365,070). Anderson teaches an ion source 10 (Fig. 1) including a magnetic holding metal member 12 made of carbon steel which has high magnetic permeability so that magnetic field can easily penetrate there through (column 5, line 47 through column 6, line 2). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to utilize carbon steel in the construction of chamber having magnets there around so that magnetic field more efficiently penetrate there through.

Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Leung I (5,198,677) taken in view of Kaufman (4,481,062) and Leung II (5,587,226) and Leung II (5,587,226), and optionally taken in further view of Cuomo (4,351,712), for the reasons stated in the rejection of claims 1, 2, 4-8 and 11-14 above, and taken in further view of Mantei (US Patent No. 4,483,737). Mantei teaches a plasma chamber 10 (Figs. 1, 2) including a filament 21 therein and having a plurality of magnets 14 surrounding the chamber wherein the plasma chamber 10 is made of a nonmagnetic material such as stainless steel (column 4, lines 29-56). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to utilize nonmagnetic stainless steel as a suitable material for a plasma chamber such as in Leung I.

Claims 17 and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Leung I (5,198,677) taken in view of Kaufman (4,481,062) and Leung II (5,587,226) ), and optionally taken in further view of Cuomo (4,351,712), for the reasons stated in the rejection of claim 1 above, and taken in further view of Collins (6,545,420)

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or Brailove (6,016,036). Collins (see Fig. 3, for example) and Brailove (see Figs. 1 and 5, for example) show that a plasma treating apparatus having a plasma source for treating a work-piece sample requires a positioning device for allowing a user to position the sample in the path of the plasma that exits the plasma source. It would have been obvious to one skilled in the art to provide a sample holder for the plasma treating apparatus of Leung I, in the manner illustrated by Collins or Brailove because a sample positioning device is required to successfully treat a work-piece as desired by Leung I.

Applicants have argued that Leung I, Kaufman and Leung II do not disclose or suggest the newly added limitation of “an oxygen plasma producing element for producing oxygen plasma with atomic oxygen ions having energies less than 100eV”. It is noted, however, that this limitation is a process-type limitation that does not so limit the present apparatus claims. This limitation is in effect a recitation of intended use that the Leung I apparatus is inherently capable of practicing.

The recitation of a particular method of use does not limit an apparatus claim, see *In re Casey*, 152 USPQ 235; *In re Rishoi*, 94 USPQ 71; *In re Young*, 25 USPQ 69; *In re Dulberg*, 129 USPQ 348; *Ex parte Thibault*, 64 USPQ 666; and *Ex parte Masham*, 2 USPQ2d 1647.

Also, Leung I (see col. 4, lines 29-30) that his apparatus produces low energy ions, such as N<sup>+</sup> ions that typically have energies of 0.25 eV to several eV. While Leung I doesn't specifically discuss O<sup>+</sup> ion energies that can be produced in his apparatus, it is noted that Leung's apparatus operates within the same range of discharge voltage and vacuum pressure as applicants' apparatus. This was discussed

on page 8 of the Final rejection mailed December 6, 2006. Therefore, Leung's apparatus is inherently capable of operating in the same way as applicants' apparatus, including producing O<sup>+</sup> ions of an energy that is less than 100 eV. Furthermore, Cuomo (see Fig. 1 and the paragraph bridging cols. 3 and 4) also discloses a thermionic cathode plasma apparatus that includes a thermionic filament 1, and Cuomo teaches that oxygen can be ionized to produce oxygen ions having an energy of less than 100 eV by using a discharge voltage of 70 volts and a current of 13 amps, which are approximately the same as Leung's operating parameters of 80 volts and 10 amps (see Leung I at col. 5, lines 35-45). Therefore, one skilled in the art would recognize that Leung's apparatus is inherently capable of producing oxygen plasma having atomic oxygen ions of an energy of less than 100 eV as now claimed. It should be emphasized that the present apparatus claims do not require that the claimed apparatus ever actually be used to produce ions of the claimed energy range, but only require the claimed apparatus has the technical capability of doing so.

Applicants have argued that none of the Figs. of Brailove and Collins contain an element labeled or referred to as a positioning device. It is noted, however, Brailove and Collins were under no requirement or responsibility to adopt applicants' chosen terminology. It is noted also that applicants' own drawings and written disclosure as originally filed do not include any element labeled or referred to as a positioning device.

Regarding Fig. 5 of Brailove the examiner agrees that this Fig. does not include a positioning device for positioning a substrate to be treated in the path of plasma exiting through the plasma source exit.

Fig. 1 of Brailove and Fig. 3 of Collins, however, do include a positioning device for positioning a substrate to be treated in the path of plasma exiting through the plasma source exit. Furthermore, while the Figs. of Collins and Brailove have been cited for emphasis regarding the use of a substrate positioning device because of their graphic portraits, the use of a substrate positioning device is inherent in all of the cited references of Lueng I, Kaufman and Lueng II. The apparatus of each of these references is intended to treat a substrate. Lueng II in particular teaches (see col. 12, lines 47-51 and col. 17, line 32 to col. 18, line 27) that a substrate held by a positioner can be immersed in plasma supplied by a plasma source having an array of filtration magnets as claimed.

Applicants have argued that the oxygen gas pressure range recited in claims 6 and 14 is a structural element. It is noted, however, that pressure is a process limitation and the presently claimed apparatus is not limited by the process limitation of claims 6 and 14. The pressure range recited in claims 6 and 14 is not a structural element as argued by applicants and the claims are not so limited. It is noted that the present apparatus claims do not recite any vacuum pump as an element of the claimed apparatus combination. If applicants had recited a particular type of vacuum pump as an element of their claimed apparatus it would have represented a structural element, but applicants did not. Also, even if for argument's sake the present claims were process claims, the disclosure of Leung I of a pressure in the vacuum chamber 43 of in the order of  $3 \times 10^{-4}$  torr makes applicants' claimed pressure range prima facie obvious. It is noted that the dictionary definition of "on the order of" means "approximately:

roughly” (see attached copy of the dictionary definition). Therefore, Leung’s stated pressure range includes pressures that are approximately or roughly  $3 \times 10^{-4}$  torr, and applicants’ claimed pressure of  $3 \times 10^{-4}$  torr is prima facie obvious in view of this disclosure of Leung. It is also noted that in *Ex Parte Khusid*, 174 USPQ 59, it was stated that where the principal difference between a claimed process and that taught by a reference is a temperature difference, it is incumbent upon applicants to establish the criticality of that difference. This stated principal clearly applies to a process pressure limitation in the same way that it applies to a process temperature limitation. In the present case applicants have not provided any showing of criticality regarding the claimed pressure range. Since applicants’ specification at page 7, lines 10-12 specifically states that “a final vacuum chamber pressure of about  $10^{-5}$  to  $10^{-3}$  provided good results”, there is no criticality between Leung’s pressure range and applicants’ claimed pressure range. It is noted also that for a showing of criticality to be convincing, the claims must be commensurate in scope with the showing. Most importantly, however, the present apparatus claims are not limited by a process pressure limitation, and the present apparatus claims do not include a vacuum pump as a structural element.

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Richard Bueker whose telephone number is (571) 272-1431. The examiner can normally be reached on 9 AM - 5:30 PM, Monday-Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Parviz Hassanzadeh can be reached on (571) 272-1435. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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/Richard Bueker/  
Primary Examiner, Art Unit 1792

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